CONFIDENTIAL

PROGRESS REPORT

FOR PERIOD ENDING

31 OCTOBER 1954

ON

4 INCH ROCKET

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Work during the month of October consisted of a continuing search for non-metallic materials which could be used in the rocket motor.

Although the design of the rocket motor as described in previous reports and discussed in conversations with the client, can in no way be considered final, it served as a basis for the selection of materials. In addition to materials selected for individual motor tubes and nozzles, various materials were examined and tested for possible use as a nozzle plate, a motor head plate and a head plate cap. These parts must exhibit sufficient strength, rigidity and resistance to heat to permit normal functioning of the multiple rocket motor without bending, breaking apart or melting.

The first multiple rocket motor was constructed from aluminum using glass cloth reinforced formica motor tubes with catalin nozzle inserts. This motor was fired repeatedly in static tests and performed satisfactorily. Efforts were made to find a material or materials which could be used to replace the aluminum nozzle plate, head plate and head plate cap. Among the various materials tested were laminated formica, celeron, marbelette, glass cloth reinforced polyester, a combination of marbelette reinforced with glass cloth reinforced polyester, and a combination of marbelette reinforced with glass filled phenolic. None of the above mentioned materials, when used as parts made up according to the original design, succeeded in withstanding the shock of the ignition blast of black powder or subsequent pressure developed from the burning of the propellant powder.

Glass cloth reinforced polyester showed some promise since it neither broke up, nor melted. A change in design of the motor could possibly permit use of this material. The possibility of eliminating the nozzle plate altogether and inserting individual nozzles into each motor tube was considered and appeared feasible. A redesign of the head plate assembly by converting it to a one piece unit, thereby eliminating a threading operation was also considered. This too, appeared feasible. A system of channels from one rocket tube to another in the head plate would assist in reducing the chamber area, thereby reducing the overall force against the chamber walls. This would, in turn, permit the use of materials with a limited tensile strength.

In addition to the search for materials described in preceeding paragraphs a number of tests were conducted using uninhibited powder grains. The use of uninhibited powder would be desireable for several reasons. First, the problem of inhibiting grains would be eliminated. Secondly, at equal pressures the burning time of the powder would be approximately cut in half. Third, the problem of unbonding of the inhibitor coating would be eliminated.

Since the surface area of the powder does not change appreciably during burning of an uninhibited grain a non-eroding nozzle is necessary to prevent a drop in chamber pressure. Metallic nozzles would therefore be required. Although the use of metallic parts has been discouraged, only a thin sleeve would be required in order to protect the throat of the nozzle. The limited use of metal, as in this case, is not considered to be particularly harmful.

In the tests conducted using uninhibited grains and steel nozzle sleeves burning was very satisfactory. The time-pressure curve was approximately neutral and the total burning time for a four inch length of JPN powder was 0.08 seconds as compared to 0.20 seconds for an inhibited grain burned under similar conditions. No measurable erosion of the metallic sleeve was observed.

PLANS FOR FUTURE WORK:

Work under this contract will proceed as outlined in previous progress reports. A continuing survey of materials will be made in order to obtain most suitable materials for construction. Flight tests will be undertaken as quickly as a suitable rocket motor can be designed and built.

FINANCIAL STATEMENT:

Amount of Contract

Expenditures for October 1954

Total Expenditures to 31 October 1954

Unexpended Balance

50X1